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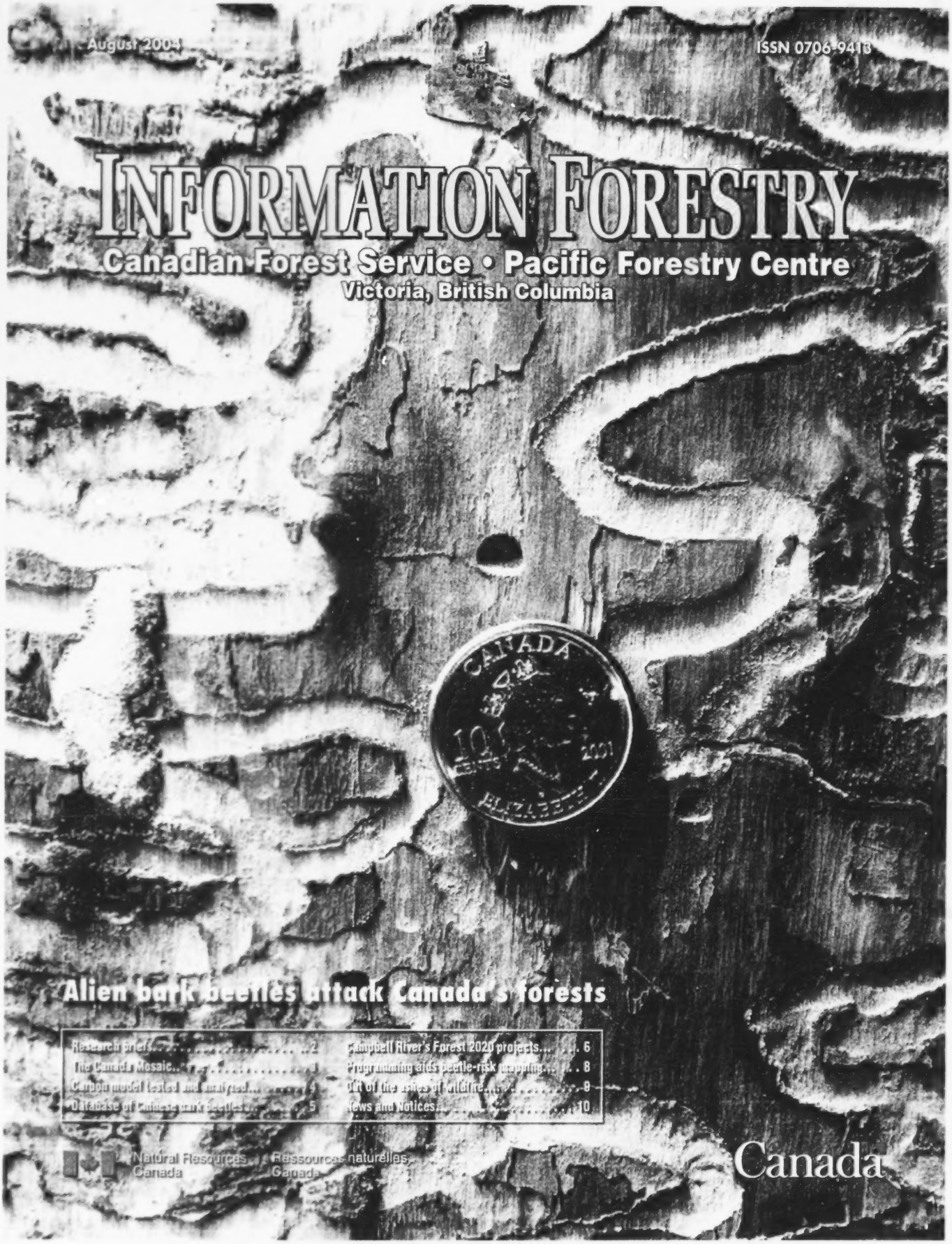

Alien bark beetles attack Canada's forests

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Extracting a measure of stress from needles

Root disease is called a hidden enemy because symptoms often don't show above ground. To confirm presence of root rot in a tree, researchers must dig up roots, or cut into root and stem bark. But by extracting a stress-induced enzyme from needles of Douglas-fir trees, Canadian Forest Service researchers at the Pacific Forestry Centre may have found a less intrusive way to determine if healthy-looking conifers are afflicted by root pathogens.

Technician Arezoo Zamani, Research Scientist Rona Sturrock, and colleagues used vacuum infiltration to remove fluid containing an intact, potentially anti-fungal enzyme from the needles. The vacuum method extracts enzymes from conifers without denaturing the proteins.

The enzyme is an endochitinase, a group of proteins many plants produce when fighting fungal infection.

"Our initial results with both seedlings and mature trees suggest that endochitinase-protein levels in the foliage of root-diseased trees are significantly greater than levels in foliage of non-diseased trees," says Sturrock (**rsturrock@pfc.cfs.nrcan.gc.ca**). "It would be helpful to be able to confirm if a tree is diseased or not by sampling only foliage."

However, infection is not the sole stressor to boost chitinase production in trees. Analysis of the needle fluid, for example, indicated the enzyme may also act as an anti-freeze agent. Needles sampled from healthy trees during a 12-month period contained higher levels of the enzyme in winter and early spring than in warmer months. More research is needed to confirm if this enzyme is indeed responsible for these functions, if the responses to the stressors are consistent, and even what different enzyme levels mean.

If nothing else, Zamani (**azamani@pfc.cfs.nrcan.gc.ca**) says, "The work enhances understanding of what is going on at the cellular level, in terms of the defense-related compounds being expressed in response to disease and other stresses."

Sources...

For more information on research featured in this issue, search the Canadian Forest Service Online Bookstore, **bookstore.cfs.nrcan.gc.ca**, for these journal articles:

Arc/Info Macro Language (AML) scripts for mapping susceptibility and risk...

Endochitinase activity in the apoplastic fluid of *Phellinus weirii*-infected Douglas-fir...

Herbivory modifies conifer phenology: induced amelioration by a specialist folivore

Look for these titles as well:

Susceptibility of lodgepole pine stands to the mountain pine beetle...

Surveillance for invasive wood borers: national and international perspectives

Nonindigenous species introductions: a threat to Canada's forests and forest economy

Good mothers for future moths

"When summer is only two or three months long, and you're a new-hatched larva, you can't wait around for days before dinner is served, says Canadian Forest Service Research Scientist Allan Carroll (**acarroll@pfc.cfs.nrcan.gc.ca**). Carroll and colleagues from the University of New Brunswick studied how spruce bud moths modify tree-growth patterns and timing to benefit offspring.

Larvae feed on new buds and shoots of white spruce trees. However, eggs sometimes hatch days or weeks before buds burst in the spring. A spruce bud moth mother corrects uncertain timing by exploiting her host's hard-wired responses to damage. She lays her eggs at the base of buds on spruce branches, and when her larvae hatch, feed, and go through their life cycle, they often chew through the shoots' stems.

The pruning interrupts apical dominance, which frees secondary buds to burst the following spring—and to burst earlier in the spring. Newly fledged moth mothers lay eggs at the bases of the secondary buds, and the basal bud nursery becomes a buffet of tender greenery just as the next generation of larvae hatches.

Pruning also delays canopy closure, which also promotes early bud burst. In fact, when selecting trees on which to lay eggs, spruce bud moths prefer spruce bud moth-eaten trees to tall, straight, valuable trees.

"The trees are more like hedges at this point," Carroll says. "The moths key in to that shape, and select damaged trees over other trees."

The moth causes greatest economic impact in eastern Canada where white spruce plantations are common.

Selection of egg-laying places by female spruce bud moths improves the suitability of trees for following generations of the insect.

Satellite map provides detailed information about Canada

A digital map pieced together by Canadian Forest Service researchers with assistance from the Canadian Space Agency shows unprecedented detail of the country. By downloading the Canada Mosaic from the internet, viewers can click and zoom in for a close-up look at almost any part of the country.

"It illustrates just how diverse the landscape of our country is," says Jeff Dechka (**jdechka@pfc.cfs.nrcan.gc.ca**), the project's coordinator at the Pacific Forestry Centre, "You won't see your house or the tree down the street, but it shows much, much higher resolution than any other map of Canada available to the public."

The digital file is 85 gigabytes—large enough to fill more than 100 compact disks. Thanks to compression technology, researchers have reduced the file to a manageable 3.3 gigabytes of data.

"We made the product available to support some of our research and national information programs," Dechka says. "It's available to others to find ways to use it." Many people downloading the image do so out of curiosity and a desire to know the country better. Others, however, have already found practical ways to incorporate it into jobs or lives. Search and rescue organizations, watershed managers, geographical information systems specialists, teachers, sailors and community planners have all accessed the Canada Mosaic and put it to use.

Canadian Forest Service scientists draw on the mosaic for a number of research areas, including the Earth Observation for Sustainable Development of Forests program and the national forest inventory. The satellite images available for the mosaic were acquired by Landsat in 1990: that year is also the baseline time set by the Kyoto Protocol for Climate Change, the international agreement regulating global greenhouse gas emissions and a driving force behind research by the Canadian Forest Service Carbon Accounting Team. Under the protocol, all changes in carbon stocks and greenhouse gas emissions will be measured against those that existed in 1990—a requirement the team is helping Canada meet by developing ways to monitor, measure and predict changes in forest carbon stocks.

"The mosaic is a look back at what conditions were in Canada in 1990," says Mike Wulder (**mwulder@pfc.cfs.nrcan.gc.ca**), a research scientist involved in remote-sensing projects at the Pacific Forestry Centre. "With it, you can monitor change within regions and across the country since that time, and measure the nature of those changes."

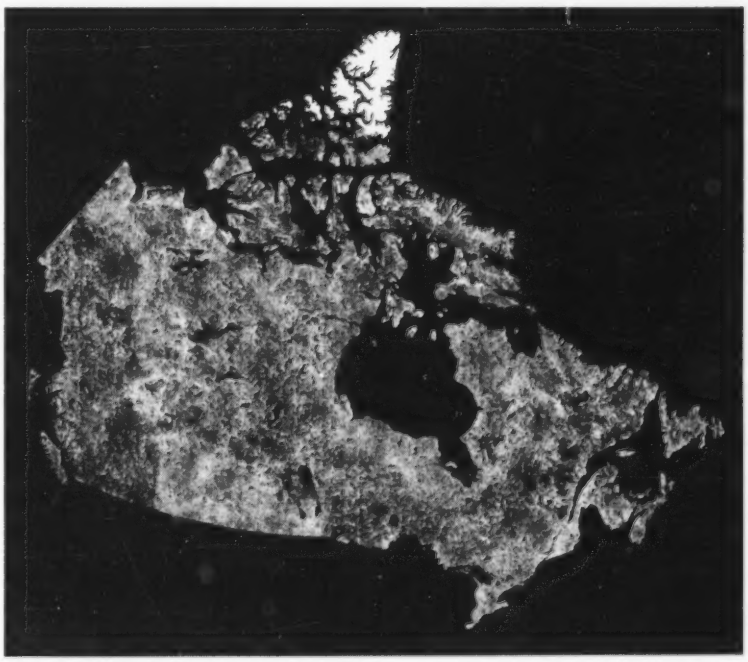
Although the Canadian Forest Service uses the mosaic to measure change within the forest sector, other sectors, including agriculture, mining or urban development, can use the image for their own projects. Researchers can also overlay spatial datasets that show how geographical features relate to each other and influence each other. For example, roads in a region are lines without context, unless you can see how they relate to farmers' fields, towns, rivers or mountains.

But, Dechka says, the most amazing thing about the Canada Mosaic is how recent advances in technology make it possible. "We can now essentially do this on a desktop computer. Ten years ago, we'd have been able to only dream about this kind of mosaic. Only a select few had the resources to put it together, and the compression technology or bandwidth didn't exist that now allows us to move the mosaic so easily over the internet."

For more information or to download a copy of the Canada Mosaic, visit **www.eosd.cfs.nrcan.gc.ca/resources/images_e.html**

Making the mosaic

- NASA and Earth Satellite Corporation combined almost 750 Landsat images into 70 digital tiles of Canada.
- Project staff converted the tiles into a geotiff format to allow the files to be manipulated using commercially available image-analysis software.
- Staff re-oriented the tiles to a Lambert Conformal Conic projection to knit them together into the standard view of Canada.
- The tiles were colour matched and blended using radiometric balancing techniques.
- Staff used commercially available discrete wavelet transform technology to compress the file from 85 GB to 3.3 GB.



The Canada Mosaic, produced by the Canadian Forest Service from tiles of more than 750 satellite images, is more highly resolved than any other map of Canada available to the public.

Prince George pilot tests forest-carbon analyses and model

The Prince George pilot indicates that carbon losses from recent cut blocks and other cleared lands in the study area are largely balanced by carbon sequestration in the residual, undisturbed forest. The study area experienced a nearly complete absence of natural disturbances from 1990 to 1999.

More than 1.4 million hectares of managed forest near the city of Prince George, British Columbia, recently served as testing ground for a forest-carbon accounting approach designed by Canadian Forest Service researchers. The project, which tracked landscape changes that had occurred over a nine-year period, is spatially explicit: it tracks forest ecosystem carbon stocks and carbon-stock changes in each individual forest-cover polygon, allowing model output to be mapped at the same level of spatial detail as any other forest inventory attribute. It was created to examine the role of forest management and land-use change on the area's carbon budget.

The Intergovernmental Panel on Climate Change's Good Practice Guidance allows for different approaches to account for changes in carbon stocks for Kyoto Protocol and United Framework Convention on Climate Change reporting, says Graham Stinson (**gstinson@pfc.cfs.nrcan.gc.ca**), one of the Pacific Forestry Centre scientists who designed the simulation model. "The spatially explicit approach is an example of the most detailed level of carbon tracking. It also opens doors to exploring scientific questions that aren't easily explored with other approaches, because results can be related directly to what is out there on the landscape."

Researchers compared satellite images mapped in 1990 with those mapped in 1999 to identify land-use and land-cover changes in the Prince George Timber Supply Area, and searched the region's archived forest inventories and aerial photography for causes of the changes. Change data, forest-inventory and growth-and-yield information, and model parameters such as litter-fall and decomposition rates were then integrated into an inventory-based forest-ecosystem carbon budget model (CBM-CFS2) to conduct a detailed, spatially explicit analysis of forest carbon stocks and carbon-stock changes for the region.

"When we started in 2002, we didn't know this approach would work, given its supplementary data requirements," Stinson says. "The pilot shows it is indeed possible—even in landscapes as large as 1.4 million hectares."

Under the Kyoto Protocol, Canada must monitor all land-use changes that occur in the country between 1990 and 2012 to determine areas in which carbon-stock changes will be determined during the protocol's first five-year commitment period, ending December 31, 2012. In addition, changes in carbon stocks within managed forests may also have to be determined during the commitment period (2008 to 2012), should Canada decide to include forest management in its national greenhouse-gas balance. The spatially explicit modeling approach tested at Prince George allows for detailed mapping of lands subject to reporting under the protocol, and moves Canada forward towards countrywide establishment of a national carbon accounting system.

It also allows researchers to examine how different landscape processes contribute to the overall carbon budget at the landscape level, and to explore uncertainties resulting from gaps in available supplementary information. According to Stinson, the researchers found that uncertainty about when disturbance events happened affects carbon estimates.

"Knowing the timing of disturbances is critical," he says. "Mapping was done at the beginning of the study period, in 1990, and at the end. It's almost impossible to tell from the satellite images how or when changes in land cover or land use occurred, but inventory records and other ancillary data collected during those in-between years help mitigate that uncertainty. If that information isn't available, the model loses precision."

The Prince George Timber Supply Area was selected for the pilot because of its near-complete forest-inventory and growth-and-yield records for the 1990s. Satellite maps of the area existed for the two required time periods, and had already been put to use in forest-cover mapping and disturbance-interpretation research by the Pacific Forestry Centre's Earth Observation for Sustainable Development of Forests (EOSD) team. Another reason the region was selected for the pilot is because of the diversity of land uses in the area, including forestry, agriculture, and urban-and rural-residential land uses.

Having proven the spatially explicit approach works there, the research team is now applying the spatially explicit carbon accounting approach elsewhere. It is already being used in other studies in British Columbia, and the team is helping set up a similar project in Quebec.

More information about the Spatially Explicit Modelling approach piloted in the Prince George Pilot region is available at **carbon.cfs.nrcan.gc.ca/Building/modeling_e.html**

Chinese-beetle database catalogs potential forest pests

"In infested areas, only two kinds of ash trees exist: dead ash trees, and dying ash trees," says Ken Marchant, of the Canadian Food Inspection Agency, the federal office that regulates food safety, and agricultural and forest health in Canada. He is referring to emerald ash borer (*Agrilus planipennis*), a jewel-coloured, wood-boring beetle from Asia that killed millions of ash trees in Michigan before crossing into southwestern Ontario three or four years ago. "Our trees have no resistance and the bug is very cold tolerant. I have no doubt it could go all the way to Edmonton or Calgary if left unchecked."

In an unprecedented attempt to contain the beetle, the agency sacrificed 85,000 healthy ash trees to create a 30-kilometre-long, 10-kilometre-wide ash-free, beetle buffer zone east of Windsor.

Because the beetle causes little damage in its home range, there was almost no information about it. Only in 2002 did scientists identify the insect, and establish a quarantine zone around infested areas.

A multi-agency task force made up of researchers and plant-protection agents from both Canada and the United States then mobilized to determine the beetle's biology, mating and feeding habits, and predators—information necessary to eradicate or control the insect.

"We're playing catch-up," says Canadian Forest Service Research Scientist Peter de Groot (**pdegroot@glfc.cfs.nrcan.gc.ca**), from the Great Lakes Forestry Centre, where much of the Canadian research on emerald ash borer is taking place. "Nobody here even knew this insect existed. It snuck in and stayed just below everyone's radar screens for years—feeding, breeding and spreading."

The initial lack of information about the pest emphasizes a need for accessible, comprehensive databases about the world's forest insects—benign or otherwise.

A new database documenting distribution of bark beetles in China is a move in that direction. The database, based on Chinese literature, was created by Lee Humble, Canadian Forest Service entomologist, and Song Li Wen, of the Jilin Provincial Academy of Forest Scientists in northeastern China.

"The more we know about insects in their home ranges, the quicker we can identify them and put control or eradication programs in place if these pests find their way to Canada," says Humble (**lhumble@pfc.cfs.nrcan.gc.ca**).

Many species of beetles are known to gnaw through the bark of trees within China's forests. Some of these have been found in Canada, brought here aboard shipments of trade goods from Asia. Few of the introduced species cause much damage, but, Humble says, "even the most benign-seeming organism can suddenly become a tree killer in a new environment."

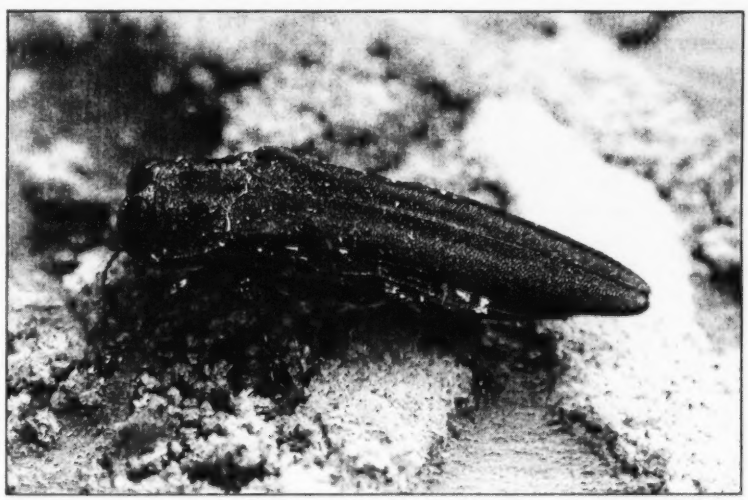
"The biggest issues we have in dealing with exotic pests are the unknowns. We don't know how they will interact with their adopted environments. We don't know where they will come from, or when or where they will appear, or even what they will be. There are many, many unknowns that we have identified, and countless unknowns we haven't even thought of yet."

As a readily available source of information about bark beetles from an area known to be a source of exotic forest pests to Canada, the database eliminates a few of those unknowns. This allows Humble and his colleagues to focus efforts and resources on other research, such as pest biology, detection and management.

For more information about exotic forest pests and forest-pest research, visit **www.pfc.cfs.nrcan.gc.ca/biodiversity/exotics** and **www.inspection.gc.ca/english/plaveg/for/fore.shtml**

Photo credit: Jerry Dowding, Canadian Food Inspection Agency

From the cover:
Emerald ash borer larvae feed on the nutrient-rich cambia beneath the bark of ash trees before burrowing deeper into the wood to pupate. By that time, the damage is done: the trees are girdled and dying. Upon emerging from the tree, the ash borer leaves distinctive D-shaped holes.



Emerald ash borer is native to China, Japan, Korea, Mongolia and Siberia. It is now also found in Michigan, Ohio and southwestern Ontario, where massive efforts are underway to contain and ultimately eradicate the aggressive ash-killer.

Vancouver Island community benefits from fas

A sliver of road remains—a narrow strip of asphalt running from bridge to barren clearing at river's edge. Pavement once covered that, too, when it had served as loading area for the island's dock. To the north and south, thickets of Douglas-fir, Sitka spruce and western redcedar grow. Along the waterfront, terraces built into banks support willows and other species that stabilize the shore and provide shade and shelter to sensitive salmon spawning grounds.

The greenery belies the island's recent past: for almost 50 years, a sawmill and a cedar-shake mill operated on Baikie Island, in the Campbell River estuary, on the east coast of Vancouver Island. Sloughs separating the island from the foreshore were dredged for log booming and storage. Trucks lumbered on and off the island; tugboats herded log booms from upriver; the island bustled and roared.

The Nature Conservancy of Canada bought the island in 2000, and turned it over to the District of Campbell River to be restored and managed as a nature reserve and park. Sign of industry has been slowly disappearing from the island.

"Some things are coming back on their own," says District of Campbell River Parks and Recreation Supervisor Susan Simson. "We're helping other things along. There are places where we'd removed pavement that needed a lot of site preparation. *Nothing* grows there—not even broom or alder, and they'll grow just about anywhere."

Fragments of rare riparian forest communities survived Baikie Island's industrial past, and are being augmented by Forest 2020 seedlings planted by volunteers.

This summer, volunteers dug up hard-packed ground once covered by industry, carted away industrial-grade fill, brought in tonnes of soil and compost, and planted the beginnings of a new forest. While local citizens provided most of the labour, part of a $27,000 grant given to the district government by Natural Resources Canada for new forest plantings helps pay for equipment, materials, and hundreds of seedlings still to be planted.

Fast-growing Forest 2020

The funding comes from a $20-million national pilot called Forest 2020 Plantation Demonstration and Assessment, part of the federal government's $1-billion *Climate Change Plan for Canada*. Administered by the Canadian Forest Service, Forest 2020 encourages industry, local governments, First Nations, and other landowners to establish plantations of fast-growing trees on unforested land. By late 2007, new plantations of trees producing more than 13.6 centimetres of growth per hectare per year—eight times the national tree-growth average—will be growing on 10,000 hectares across the country. To date, 38 projects under the program are underway or planned in British Columbia.

In most of Canada, fast-growing trees mean hybrid poplars, larch, and Norway and white spruce. On the west coast, with its long growing season, many species—including Douglas-fir, Sitka spruce, cedar, maple, alder—super-produce fibre and quickly store carbon.

This enables west coast program participants such as the District of Campbell River to quickly rehabilitate and convert open areas back to green cover.

"We're putting back what was originally there," says Simson, of Baikie Island. "A conifer mix, with some other trees—native maples, willows, maybe some more cottonwoods along the estuary."

The primary goal of Forest 2020 is long-term carbon sequestration, says Dean Mills (**dmills@pfc.cfs.nrcan.gc.ca**), who administers the program in British Columbia. Carbon dioxide is a greenhouse gas, and must be accounted for under the Kyoto Protocol for Climate Change, which Canada endorses. Trees take carbon dioxide from the air, and transform the carbon into wood: fast-growing trees do it faster. Carbon eventually stored within Forest 2020 plantations will be tallied in Canada's accounting of the country's greenhouse gas emissions, as required under the protocol.

"Forest 2020 allows for a shift in how we view the forest plantations," says Mills. "Plantations and forests have many functions and can be used for more than just fibre. As long as Forest 2020 plantations sequester carbon at the prescribed rate,

t-growing, carbon-storing plantation program

they can address other values such as quality of life or wildlife or economic development or other community objectives."

Although wildlife, fisheries and local citizens benefit directly from the Baikie Island restoration, there are indirect payoffs. Campbell River is slated to become a stop on the cruiseline route to Alaska in 2005: new forests on nearby Baikie Island and other riverside lands will provide an inviting introduction to the town for shipboard visitors. In recognition of that, the district recently passed bylaws limiting development along the estuary to light-industrial or commercial use: existing heavy industry will gradually phase out, leaving the estuary to birds, fish, deer and people using pathways and picnic areas.

"Baikie Island is really a high-profile project within this community," Simson says. "Support has been amazing. The Campbell River Noon-Hour Rotary Club built trails and pedestrian bridges. The Discovery Coast Greenways Land Trust brings in many volunteers every spring to remove broom and blackberries and other invasive species. The Nature Conservancy is involved, the Department of Fisheries and Oceans, BC Hydro... a lot of people and organizations are making things happen."

The ultimate waste-recycling loop

Baikie Island is one of two Campbell River projects benefiting from Forest 2020 funding. Further inland, the district government invested the rest of the federal grant in a hybrid-poplar plantation that will eventually provide pulp fibre.

The plantation will not only bring in cash to help pay for itself, it saves the region money. Instead of paying to store and ship biosolids from the region's 10-year-old waste-treatment plant for re-use elsewhere, engineers use the material to fertilize the plantation, which is located next to the treatment plant.

"This project had great potential because we owned a large piece of land around the plant, which eliminates transportation costs altogether," says District of Campbell River Engineering Supervisor Ron Neufeld. "It turned out, after we'd done all the necessary field tests of the site, the project was not only a good match financially, but had all the right check marks in terms of soil, groundwater and other environmental conditions."

The province's regulations for recycling organic matter require a number of processes and conditions, including public consultation, site security and site preparation, to be met before a project like this can proceed. At two public meetings hosted by the district to discuss the project, the only concern raised by local residents was the possibility of odour, a problem the district has effectively minimized through appropriate application techniques. Following the public process, the site was fenced and cleared of bushes, and surrounded by a buffer zone and perimeter ditches.

After an initial spring application of biosolids in May, poplar whips were planted at four-metre intervals in rows covering 10 hectares of the site.

The trees received one more application of biosolids fertilizer during the summer months. "The number of applications and the rate of application depends on demand," Neufeld says. "As the trees grow, demand will increase."

Plantations are a cost-effective way to deal with Campbell River's biosolid waste and improve the environment.

"We anticipate that the poplar crop will be ready for market in 10-13 years," Neufeld says. "Once mature, the trees would likely be used for production of paper – maybe even toilet paper, which would really create an appropriate re-use cycle for this project."

Under Forest 2020, 10,000 hectares

- of non-forested land will be converted to fast-growing tree plantations by 2007.
- of fast-growing trees planted by 2007 could sequester as much as 0.4 Megatonnes of carbon each year by 2012, the end of the Kyoto Protocol's first commitment period.

Ten hectares surrounding Campbell River's waste-treatment plant were prepared and planted with hybrid poplars this spring, which will recycle biosolids from the plant into wood fibre.

Scripts refine mapping of beetle susceptibility and risk

Automating risk calculations

Scripts are programming instructions that tell existing computer programs how to do specific tasks. The mountain pine beetle risk-model scripts automatically:

- Eliminate arbitrary discrepancies in interpretation of field data.
- Eliminate overly large, table-generated differences in susceptibility ratings.
- Incorporate calculations for beetle pressure.
- Permit users to track what happens when data is entered and trace the effects back to their source.
- Can be updated or adjusted to meet the needs of users.
- Interfaces with existing forest inventory databases and beetle surveys.

Programming scripts developed by researchers at the Pacific Forestry Centre help industry professionals map stand susceptibility and risk of mountain pine beetle infestation using forest inventory databases.

The three scripts were developed within Arc/Info Macro Language, a commonly used, readily available programming environment. They fine-tune interpretation of susceptibility and beetle pressure to arrive at an estimate of relative risk of beetle-caused tree death within a stand, using the model developed 12 years ago by Canadian Forest Service researchers Terry Shore (**tshore@pfc.cfs.nrcan.gc.ca**) and Les Safranyik (**lsafrany@pfc.cfs.nrcan.gc.ca**). The model incorporates knowledge of mountain pine beetle biology and integrates operational knowledge of how forestry is conducted in British Columbia.

"The scripts automate the system to a certain extent," says Shore. "Because some of the information necessary for running the model can only be obtained by going into the field and collecting it the use of the system may be limited. The data is often difficult to get from forest inventory databases, or it simply isn't available. What the scripts do is search the inventories for the best available data, and plug that into the model."

By doing this, says Research Scientist Mike Wulder (**mwulder@pfc.cfs.nrcan.gc.ca**), the scripts also standardize the model's implementation.

"Up to this point, there has always been a certain amount of latitude in how the model is initialized, in terms of what compromises are made, to suit the forest-inventory data," he says. "Analysts now need to make fewer subjective decisions."

This creates consistency in how susceptibility and risk are rated among different users and throughout the province.

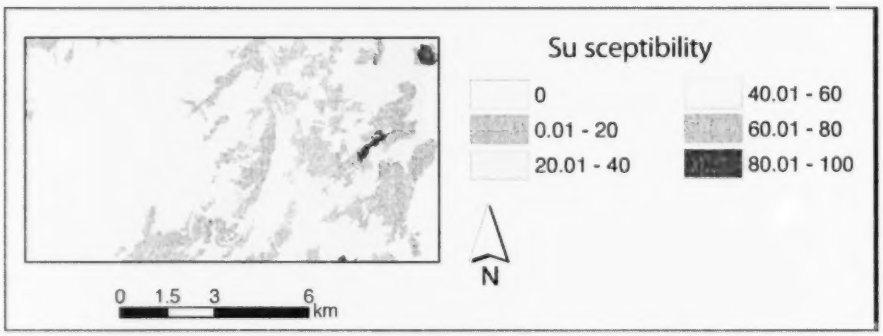
The scripts make it easier for a GIS (geographic information systems) person in a field office to come up with reasonable susceptibility and risk indices, Shore says, adding that although the scripts improve the consistency of the ratings, they cannot replace data obtained through ground validation.

"This provides the best application of data at the large scale, within the limitations of existing inventory databases. Naturally, we'd prefer to see the ground data collected and used instead, as that would improve the accuracy and sensitivity of the systems."

The script-adapted model also incorporates other recent advances made by Shore and his colleagues in determining mountain pine beetle susceptibility and risk. For instance, continuous functions describing age, density, and location eliminate large differences in risk values that had occurred previously when distinct, stepped class values were used in the model. In the original system, susceptibility of an 80-year-old stand was rated markedly lower than that of an 81-year-old stand, all other variables being equal.

The scripts can be adapted to most operational GIS used for inventories and beetle surveys in the province, and can be used with either newer forest inventories that include the Vegetation Resource Inventory, or older systems, based on Forest Inventory Polygons.

The scripts can be downloaded from **www.pfc.cfs.nrcan.gc.ca/entomology/mpb/detection/remote/tools_e.html**. For more information on detecting mountain pine beetle, visit **www.pfc.cfs.nrcan.gc.ca/entomology/mpb/detection/**



To determine susceptibility, or potential for loss of volume within a stand, the Arc/Info Macro Language script combines percentage of pine with the age, density and location of pine in the stand.

Mushroom research follows in wake of province's wildfires

Like many other families in British Columbia, Michael Keefer and his family inhaled smoky air, felt their house shake as water tankers rumbled past every 10 minutes, heard helicopters and water bombers flying over day and night, and stood on one-hour evacuation alert for weeks on end last year. They live 10 kilometres from the Lamb Creek fire site, which blazed across 11,000 hectares of forested mountainside 25 kilometres southwest of Cranbrook—one of 28 fires that burned in southeastern British Columbia last summer.

Despite the anxiety and discomfort, the ethnobotanist for the Ktunaxa-Kinbasket Treaty Council says, "People like me were gleefully rubbing their hands thinking of all the mushrooms that were coming."

Keefer is referring to morels, a tasty, prized mushroom that grows out of the ashes of burnt forests. "We didn't know how much or where in the burn they would be, but they were sure to come—as were the pickers."

Now, anyone who goes walking in the burn site is bound to bump into somebody carrying a bucket of mushrooms. "In Lamb Creek alone on any given day, there must be at least 50 pickers," says Keefer, "There's also the Plumbob fire site, and the White River–Middle Fork site.... There's potentially a lot of money to be made from morels around here."

Keefer is taking part in a study that partners the Ktunaxa-Kinbasket Treaty Council with researchers at the Canadian Forest Service and Royal Roads University's Centre for Non-Timber Forest Resources. The aim of the study is to assess impacts of non-timber forest products, such as morels, on local communities, as well as the interaction of resources' supply and demand.

The researchers will also try to identify plant associations necessary to morel growth and survival, which will increase understanding of morel ecology and biology. The association between morels and fire is well documented, but, according to Pacific Forestry Centre Research Scientist Richard Winder (**rwinder@pfc.cfs.nrcan.gc.ca**), who works with Keefer on the project, "Not every burn site produces morels, and not every area within a burn site. And although they're found primarily in burn sites, morels are found in other places as well. We'd like to determine what conditions or plants are needed to make a site a good morel-producing area."

Because of the dependence on forest fire, morel supply is capricious. Bumper crops of morels appear early in the spring after a fire, with quickly decreasing numbers appearing in subsequent years.

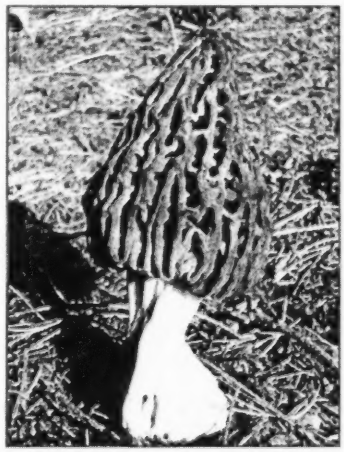
"Demand tends to follow supply," says Winder. "There are a lot of burns, and the supply of morels goes up, which meets existing demand and lowers prices, but it also stimulates and generates additional demand. Then the supply runs out and demand eventually returns to normal. It's hard to develop a sustainable industry under these conditions."

According to Keefer, this year's pickers are harvesting as much as 40 to 50 pounds of wild morels per person per day from the Cranbrook area. Prices paid to pickers at the buying stations in the area fluctuate. The abundance of fires last year has caused prices to be relatively low, ranging in May from $3.00-$7.00 per pound—paid in cash. Part of the project involves determining where pickers and buyers are from, and how much of their annual income comes from picking mushrooms and other non-timber forest products. As much of the business between pickers and buyers is undocumented, few pickers and buyers may provide accurate figures. However, for non-timber forest products to be considered in the overall mix of a community, the forestry industry and provincial regulations, this information is crucial.

"There's been very little research about non-timber forest products on the whole, and when it comes to morels, there's a real need for more information," says Keefer. "You hear stories and see figures, but we have a long way to go to verify them."

Many of the pickers, Keefer says, are local residents, but some are from Alberta or Saskatchewan, and some from the north coast of British Columbia. "Those tend to be the professional pickers. They harvest morels in the spring, some of them pick wild berries and boletes in the summer, and move on to pine mushrooms and other species in the fall, and through the winter they're often gathering salal or boughs for the florist market."

Together, wild morels, chanterelles and pine mushrooms from British Columbia forests comprise a multi-million-dollar non-timber forest products industry.



Morels are one of the few mushrooms associated with wildfire in British Columbia forests.

For information about mushrooms of the Pacific Northwest, visit **www.pfc.cfs.nrcan.gc.ca/biodiversity/matchmaker**; for information about non-timber resources, visit **www.for.gov.bc.ca/hre/ntfp/** or the Royal Roads University website, **www.royalroads.ca**

News and Notices

Program helps landowners control beetle

The Canadian Forest Service is helping British Columbia forest landowners manage mountain pine beetle and rehabilitate their beetle-infested forests. More than 30 owners of non-industrial private forestlands received funding this year under the Private Forestlands Rehabilitation Program, part of Natural Resources Canada's five-year Mountain Pine Beetle Initiative.

Forestry liaison officers Helena Adamowicz and Maureen Scott traveled the province early in the year to meet with landowners, identify needs, monitor projects that have been funded, and provide technical advice.

"It takes time for word about new programs to get out," says Adamowicz (**headomow@pfc.cfs.nrcan.gc.ca**). "We needed to explain to people what the program was about. We're working with the woodlot owners' association to develop a mailing list for all the people who might be eligible."

The rehabilitation program covers up to 80 percent of costs associated with management activities to mitigate mountain pine beetle impact on private forestlands, to a maximum of $25,000 each year. Eligible activities include ground or treatment surveys, harvest planning, beetle proofing, pheromone baiting, site preparation, seedling acquisition, and reforestation.

To be eligible, private forestlands must be between 10 and 2,000 hectares in size within the beetle-infestation area. Approved projects may require hiring a forestry consultant to supervise and monitor project activities and treatments, and ensure appropriate treatment standards and procedures are followed.

For more information on the Mountain Pine Beetle Initiative's Private Forestlands Rehabilitation Program, visit **mpb.cfs.nrcan.gc.ca/private_lands/index_e.html**

A new guide by the Canadian Forest Service provides owners of small-scale woodlands with information on how to reduce losses on their property to mountain pine beetle. Visit the forest service online bookstore to order a free copy of *Mountain Pine Beetle Management: A guide for small woodlot owners* (bookstore.cfs.nrcan.gc.ca).

International cooperation helps contain disease

Scientists and plant-health officials hope answers to key questions about sudden oak death will help them eradicate the latest infection by the disease in British Columbia and prevent future recalls of nursery stock as happened earlier this year.

An international panel of plant-protection officials and scientists studying sudden oak death and *Phytophthora ramorum*, the organism that causes it, met in June to discuss the pathogen's biology, detection, treatment/mitigation and risk analysis.

"We know very little about this organism, how it spreads, or how long spores persist on plant surfaces or soil," says Eric Allen (**eallen@pfc.cfs.nrcan.gc.ca**), research scientist with the Canadian Forest Service and a member of Canada's Sudden Oak Death Task Force. "We need to know, for instance, if a lily, which is not a host, planted next to an infected camellia can harbor the disease, or if we have to dig up the entire garden."

Earlier this year, camellias at a southern California nursery that grows stock to supply nurseries across North America were found to be infected. Officials across Canada and the U.S. recalled stock from more than 800 nurseries, including 25 in British Columbia. The Canadian Food Inspection Agency, the federal agency that regulates food and plant health in Canada, set up a hotline for homeowners to report purchases of suspect plants, and worked with the landscaping and nursery industry to collect, test, and dispose of approximately 1,500 camellias sold and planted in gardens across the province since September, 2003.

By July, more than suspect plants had been collected, and testing for the disease continues.

Sudden oak death could decimate British Columbia's $800-million-per-year nursery trade, as well as seriously affect the province's forests. The disease, which infects a variety of garden plants, also infects native forest species Garry oak, Douglas-fir, arbutus, maple, Sitka spruce, rose and huckleberry.

This is the second incursion of sudden oak death into the province. In 2003, six infected rhododendrons were identified at a Vancouver nursery. After being quarantined and sanitized, it was allowed to reopen. Monitoring continued for one year; no further sign of infection was found.

More information on sudden oak death can be found at **www.pfc.cfs.nrcan.gc.ca/news/suddenoak_e.html**

People

Departure

Director of Programs, Planning and Operations **Elaine Teske** has retired after 31.5 years with the federal public service, 26 of them with the Canadian Forest Service, Victoria. She began her career with the forest service as Communications Manager and Editor of Information Forestry. In the last 10 years she was Director of the federal component of Canada-British Columbia Forest Resource Development Agreement (FRDA) and most recently her work as Director of Programs, such as First Nations, Model Forests, Forests 2020 and the land-based component of the Mountain Pine Beetle Initiative, have provided her the opportunity to work directly with many clients of the Canadian Forest Service, both at the municipal and provincial government level, as well as First Nations, non-government environmental groups, private landowners, as well as many interest groups involved in the forest sector. She will now spend time interacting with golf instructors, travel agents and volunteer organizations, as she pursues her retirement interests.

Arrival

Raoul Wiart joins the Canadian Forest Service as the Pacific Forestry Centre's new Director, Programs, Planning and Operations. In addition to directing collaborative forestry programs, Model Forests and First Nations Land Claims support at the research centre, he also manages technology transfer, marketing, communications and publishing services.

"I look forward to participating in finding solutions to some of the many challenges we face in forestry today in Canada," says Wiart.

He brings to the position over two decades of experience as a resource management consultant, manager with the British Columbia Ministry of Forests, and research associate with the University of British Columbia in the combined faculties of Forestry and Soil Science.

Accolades

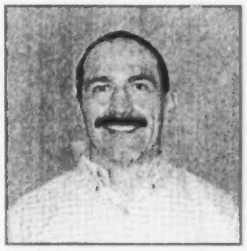
Behind many a great scientist stands another great scientist ... especially at the Canadian Forest Service in Victoria where four exceptional young British Columba graduate students are doing forest-related research under the guidance and tutelage of leading-edge scientists. The students are recipients of Pacific Forestry Centre graduate student awards (**www.pfc.cfs.nrcan.gc.ca/award**), a distinction that brings with it $5,000 and the chance to participate in research on vital national programs.

For **Philippe Tanguay** of the University of British Columbia, an investigation into the use of green fluorescent protein for studying interactions between *Colletotrichum gloeosporioides* and western hemlock dwarf mistletoe brought him to the lab of supervising Research Scientist **Simon Shamoun**.

For **Irina Boldor**, also of the University of British Columbia, an interest in modeling fire at the stand and landscape level in the southern interior of the province put her in touch with Fire Research Officer **Brad Hawkes**.

Continued on page 12

Elaine Teske



Raoul Wiart

Simon Shamoun and Philip Tanguay

Comings Events

Restoration on the Edge: International Conference on Ecological Restoration

Presented by the Society for Ecological Restoration International, Canadian Land Reclamation Association, and Technical and Research Committee on Restoration
August 23–27, 2004; Victoria, BC
Information: **www.serbc.info/public/ser_seminar**

One Forest under Two Flags: Joint 2004 AGM and Convention

Presented by the Canadian Institute of Forestry and the Society of American Foresters
October 2–6, 2004; Edmonton, Alberta
Information: **www.cif-saf-2004convention.org/natcon/**

2004 Annual Meeting: NAPPO

Presented by the North American Plant Protection Organization
October 18–22, 2004; Vancouver, BC
Information: **wolffg@inspection.gc.ca**

Fires, Storms and Pests—Crises in Our Urban Forests: 6th Canadian Urban Forest Conference

Presented by the Tree Canada Foundation
October 20–21, 2004; Kelowna, BC
Information: **www.treecanada.ca/cufc6/**

Monitoring the Effectiveness of Biological Conservation

Presented by the Centre for Applied Conservation Research (University of British Columbia), the British Columbia ministries of Water, Land and Air Protection, and of Forests, IUFRO, the Smithsonian Institution, and the U.S. Forest Service
November 1–5, 2004; Vancouver, BC
Information: **fcsn.bc.ca/conferences/mebc/index.html**

2004 Forest Pest Management Forum

November 16–18, 2004; Ottawa, ON
Information: **www.forum.glfc.forestry.ca**

Continued from page 11

Fellow student **Cornel Lencar**'s look at incorporating Bayesian Belief Networks into decision-support systems to predict geographic spread and risk for the mountain pine beetle introduced him to mentor and scientist emeritus Les Safranyik.

And **Thomas Hobby** of the University of Victoria is gaining new expertise working with Forest Economist **Brad Stennes**. His focus is on a cost-benefit analysis of mitigating catastrophic forest fires via fuel load reductions.

For information on the awards, visit **www.pfc.cfs.nrcan.gc.ca/award**

Transfer

Earth Observation for Sustainable Development of Forests (EOSD) Remote Sensing Data and Product Coordinator **Jeff Dechka** changed offices within the Pacific Forestry Centre to serve as Acting Director, Forest Information. He oversees the delivery of national programs including National Forest Information System, the National Forest Inventory and EOSD, and the centre's remote sensing research activities. These programs involve working in collaboration with teams of experts and specialists from Canadian Forest Service research centres, and other federal branches, agencies and departments, as well as from the provinces and territories.

New from the bookstore

Arc/Info Macro Language (AML) scripts for mapping susceptibility and risk of volume losses to mountain pine beetle in British Columbia. Wulder, M.A.; Seemann, D.; Dymond, C.C.; Shore, T.L.; Riel, W.G. Technology Transfer Note 33.

Scripts macrolangagiers Arc/Info (MLA) pour cartographier la susceptibilité et le risque de pertes de volume à la dendroctone du pin ponderosa en Colombie-Britannique. Wulder, M.A.; Seemann, D.; Dymond, C.C.; Shore, T.L.; Riel, W.G. Note de Transfert Technologique 33F.

Mountain Pine Beetle Management: A guide for small woodlot owners.

Lutte contre le dendroctone du pin ponderosa: Guide à l'intention des petites exploitations forestières.

Blister-Rust-Resistant Western White Pines for British Columbia. Hunt, R. Information Report: BC-X-397.

The Bridge: Newsletter of Natural Resources Canada's First Nations Element of the Mountain Pine Beetle Initiative, and of the British Columbia First Nations Forestry Program. 12; Spring 2004. Murphy, B., editor.

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Next issue...

Spruce Beetle in Yukon forests

and

Overharvesting threatens disease-resistant pine